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The centennial of the planetarium

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The first planetarium projector was completed 100 years ago, providing the public with an unparalleled view of the night sky. The International Planetarium Society is marking this major anniversary with celebratory events across the globe.

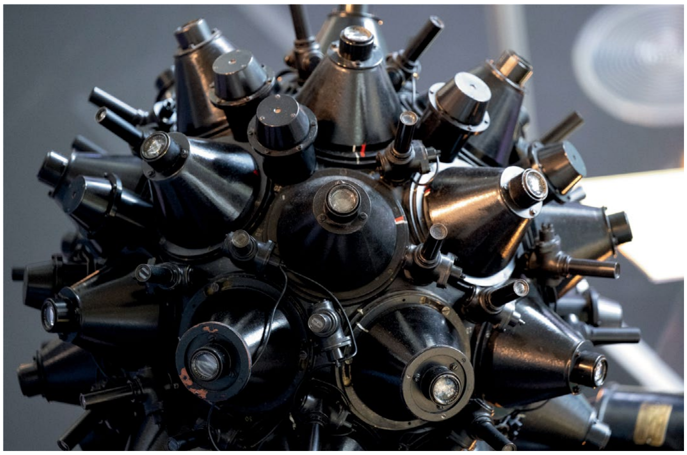

Fig. 1 | The first planetarium projector. The projector was built by the ZEISS company in 1923, and is on display at the Deutsches Museum in Munich, Germany.

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The history of planetariums starts with the desire of humankind to reproduce the unique beauty of the night sky. Marvellous machines like the Gottorp Globe (1664), the Huygens Planetarium (1682), the Eisinga Planetarium (1774) and the Atwood Celestial Globe (1913) could reproduce the starry sky or the motion of our planet. Then Oskar von Miller, the founder of the Deutsches Museum, who was looking for an innovative apparatus for the museum, ordered the construction of what would become the first planetarium projector. Zeiss designer Walter Bauersfeld took on the job and some years later, on 21 October 1923, the 'Wonder of Jena' shone its first mock starlight and, on 7 May 1925, the first planetarium was opened in Munich, Germany.

Those stars were just the beginning. Over the years, planetariums have gone through monumental changes. The first projector, the Zeiss Mark I (Fig. 1), could show only the starry sky of the Northern Hemisphere, but newer projectors used a dumbbell form to reproduce the skies of both hemispheres. From their beginnings in Germany, planetariums have spread through Europe to the whole world. Vienna received the first planetarium outside Germany, and the Adler Planetarium (Chicago, USA) was the first planetarium built outside Europe, in 1930. The planetarium built in Oceania (Sydney, 1950) included the Southern Hemisphere in the planetarium map, followed by the first South American planetarium, installed in Montevideo in 1955 (Fig. 2). The first African planetarium was inaugurated in Johannesburg in 1960, and the first Asian planetarium was built in India three years later.

The demand for activities inside schools or even further-flung places motivated the metamorphosis of planetariums to a mobile structure, first presented in 1948 by the Boston Museum of Science. Originally produced in wood, nowadays inflatable domes allow a planetarian to carry the whole Universe inside the boot of a car. Mobile domes have helped planetariums to reach distant places where people would never otherwise have the opportunity to discover the wonders of the Universe.

Planetariums started to use additional slide projectors in the 1950s and, in the 1960s, full-dome images and special-effects projectors became part of the show. The digitalization of the following decades changed planetariums forever. Nowadays, digital planetariums allow the visitor to fly through the Valles Marineris or the Saturnian rings, visualize the arrangement of dark energy or dark matter in the Universe, or witness galaxies collide. The planetarium has evolved to stay up to date with the very latest astronomical discoveries. The first planetariums were built right after the great Shapley–Curtis debate (essentially, whether spiral nebulae are faraway galaxies, implying that the Universe is much bigger than had been thought) and nowadays planetariums have real-time rocket launch footage and can livestream a rover landing on Mars. Figure 3 shows a high-resolution Martian terrain in a modern planetarium.

Today, there are more than 4,000 planetariums around the world, playing a very important part in the popularization and communication of science, especially in discussing the role of astronomy in our society[1]. The European Southern Observatory (https://www.eso.org/public/portugal/videos/archive/category/fulldome/), as well as NASA (https://svs.gsfc.nasa.gov/Gallery/FulldomeGallery.html) and others, has a collection of full-dome internet shows to promote these advances. For a hundred years, planetariums have been building a bridge between astronomy and society.

We recently reached eight billion people living on our Pale Blue Dot (https://en.wikipedia.org/wiki/Pale_Blue_Dot). This milestone suggests a series of obligations, some of which can be met by the planetarium community. Our modern way of life has spilled an enormous amount of light into the night and people have lost contact with the starry sky that has awed humankind for thousands of years[2]. The most obvious role of the planetarium in our society is to show people what they are missing, but some hard challenges remain, such as conveying the science of climate change. Shows and educational kits have been developed in recent years to discuss climate change with planetarium visitors (https://www.fddb.org/fulldome-shows/our-living-climate/, https://museumsvictoria.com.au/media/1852/olc_teacher_notes.pdf, https://www.colorado.edu/fiske/showtimes/fulldome-films-star-shows/fulldome-film-climate-change-our-backyard).

Of course, planetariums are tightly connected with science education, from young preschoolers to college students – always following national standards but also focusing on science literacy

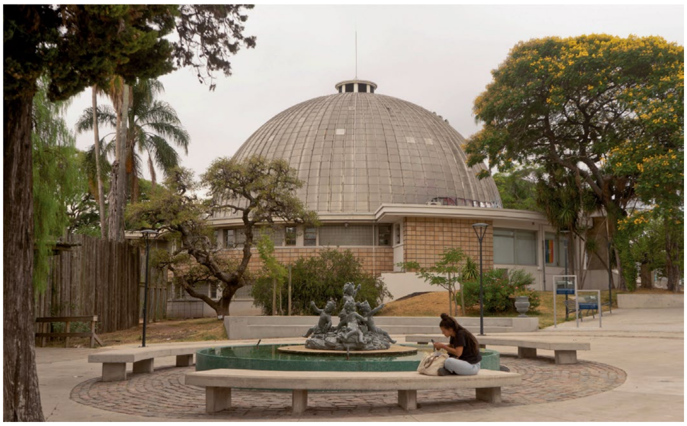

Fig. 2 | The first planetarium in South America. The planetarium in Montevideo, Uruguay, was opened in 1955.

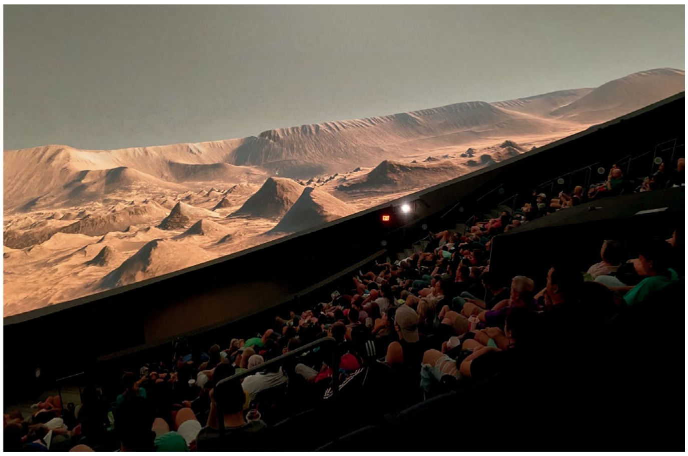

Fig. 3 | Public planetarium show depicting an image of the Martian surface.

and engagement[3–5]. Planetariums usually offer teacher-training courses and produce educational materials to accompany planetarium shows. The International Planetarium Society has a committee dedicated to supporting education in the planetarium, which has produced a white paper called 'The Value of Education in the Planetarium (https://www.ips-planetarium.org/page/planetariumeducationvalue).

The International Planetarium Society has also been engaged with equity, diversity and inclusion issues, not only to serve planetarium visitors better, but also to grow as a community. One of the most difficult tasks for a place that has been developed to be visually immersive is to design ways to receive a visually impaired public effectively. Fortunately, a continuous improvement in materials and methods has enabled planetariums to welcome everyone under the dome. A fine example of such inclusion is the Galileo Galilei planetarium, in Buenos Aires, Argentina[6].

Planetariums still face the challenge of an unfair geographical distribution. If we search for planetariums all over the world (https://planetariums-database.org/), we can easily find an enormous number of domes in Europe, the USA and Japan, but very few in Africa. In Fig. 4, we show the distribution of planetariums per million people and per million square kilometres. Even within the so-called developed and rich countries, there is an uneven distribution of domes in some Canadian provinces and in some countries of the UK, for example. A study of German museums shows that the geographic proximity of museums is one of the major influences on the likelihood that the public will visit the institution[7].

At first, when comparing the number of planetariums with gross domestic product (GDP), we find no correlation. However, when we neglect the countries that have no planetarium at all, we find a Pearson correlation of 0.3 for GDP and the number of planetariums per square kilometre and 0.45 for GDP and the number of planetariums per million inhabitants. The difference between the two indices may arise from huge countries with large areas of low population. In any case, the increase in the number of planetariums with GDP could indicate either that planetariums are mainly properties of rich countries, with a few exceptions, or that investment in science education through the support of planetariums promotes the economic development of a country. In both cases, it is our duty to support the dissemination of planetariums all over the world.

Considering only the data of the countries that are participants in the scientific Programme for International Student Assessment, we find correlations of GDP versus number of planetariums per million inhabitants of about 0.57 and versus number of planetariums per square kilometre of about 0.50, which may reveal the importance of planetariums for science education. The correlation may also be related to the new roles of the modern planetarium, which discuss science in general and promote a global view of our planet.

The celebration of the Centennial of the Planetarium is an auspicious time to spread new planetariums all over the world. Planetariums can be a family business, with domes a few meters in diameter, or can be part of a science museum with domes 30 metres or more across. A planetarium can be connected to a school district or a university. But, no matter the type or size of planetarium, we are all engaged in a mission of science popularization and astronomy education. A single planetarium engages an audience of 10,000–500,000 people per year and, together, the 4,000 planetariums distributed around the globe receive about 140 million visitors each year, ranging from preschoolers to senior citizens, from science experts to curious people.

The planetarium industry provides advanced technology with an increasing number of projectors that work together through a network of high-speed computers, which also control sound and lighting systems, as well as software that precisely simulates a universe that goes much deeper than projecting just our local, visible stars on the dome. Hybrid systems that mix the best of optical-mechanical and digital systems bring the heavens down to Earth and allow visitors to immerse themselves in the wonders of astronomy. Mix it up with expert planetarians, actors and appropriate music and visitors will have an experience that will shake their mind, body and soul.

The Centennial of the Planetarium has now arrived (https://planetarium100.org/). This article is just a very brief introduction to the planetarium community and also an invitation to the astronomy community to visit the planetarium nearest to you. Most astronomers have been inside a planetarium before but how many have been in recent years? Planetariums have changed, not only technologically speaking, but also in many other ways. Give a planetarium the opportunity to astonish you. Visit a planetarium and talk to its director or planetarian. You will be very welcome!

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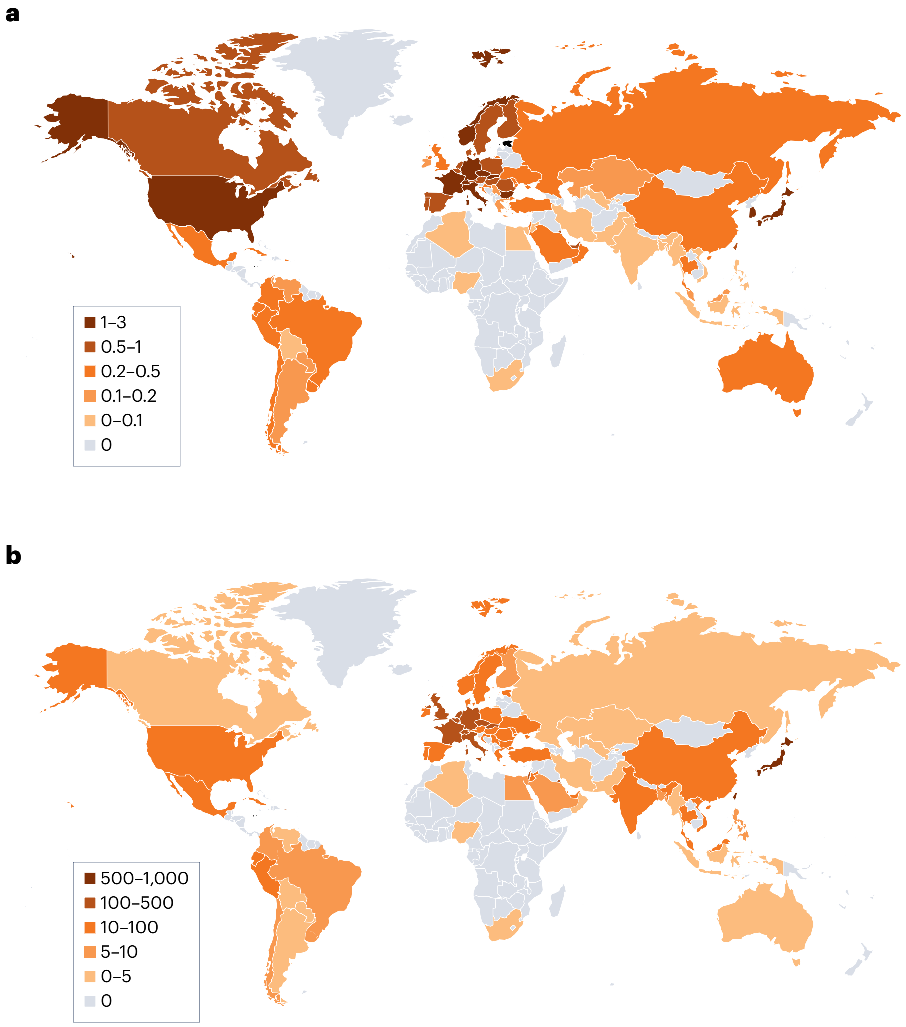

Fig. 4 | Distribution of planetariums across the globe. a, Number of planetariums per million people; **b**, Number of planetariums per million square kilometres.

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References

1. Petersen, C. C. The unique role of the planetarium science center in science communication. In *Communicating Astronomy With The Public Conf. Proc.* (eds Robson, I. & Christensen, L. L.) (ESO, 2005).
2. Moore, C. A., Richman, A. M. & Chamberlain, V. D. In *The Inspiration Of Astronomical Phenomena* ASP Conference Series Vol. 441, 451 (Astronomical Society of the Pacific, 2011).
3. Thornburgh, W. R. *The Role Of The Planetarium In Students' Attitudes, Learning, And Thinking About Astronomical Concepts*. PhD dissertation, University of Louisville (2017); https://istardb.org/1895/
4. Plummer, J. D. & Small, K. J. In *Ensuring STEM Literacy: A National Conference On STEM Education And Public Outreach* ASP Conference Series 407–410 (Astronomical Society of the Pacific, 2014).
5. Plummer, J. D. *J. Res. Sci. Teach.* **46**, 192–209 (2009).
6. Cacace, G. & Pereyra, A. *Rev. Mex. Astron. Astrofis. Conf. Ser.* **54**, 39–42 (2022).
7. Kirchberg, V. *Poetics* **24**, 239–258 (1996).

Competing Interests

The authors declare no competing interests.